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ABSTRACT

This document records the procedures followed by the South Carolina State Board for Technical and Comprehensive Education in developing a two-year curriculum for civil engineering technology with a learner-oriented, open-entry/open-ended individualized format relying heavily on the use of audiovisual aids and hands-on experience with software and equipment. The basic format for each course is a combination of written modules that form a linear progression through a series of related objectives. The linear progression of written material is broadened by a series of alternate media developed to be used at different points in the curriculum. The faculty in the 10 South Carolina institutions which currently offer the Civil Engineering Technology program were organized to form a nucleus of course content experts. This faculty group identified 11 courses which should be included in the new program and put into the new format. Course objectives were identified, and a collective list of 163 competencies to be required of program graduates was compiled. Individual community college faculty were hired to write the individual courses, with the University of South Carolina faculty serving as consultants. When the writing of each course was completed, it was validated by field test. (Author/NHM)

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SELF-PACED LEARNING IN CIVIL ENGINEERING TECHNOLOGY:

AN APPROACH TO MASTERY

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STATE BOARD FOR TECHNICAL AND COMPREHENSIVE EDUCATION
COLUMBIA, SOUTH CAROLINA

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INTRODUCTION

In 1972, the South Carolina General Assembly passed Act 1208 which created the State Board for Technical and Comprehensive Education. The newly created State Board replaced the existing State Advisory Committee for Technical Training and was given jurisdiction over all two-year, state supported, post secondary institutions and programs except for the University of South Carolina and Clemson branch campuses. During its formative years as an advisory committee and following its elevation to Board status, the system grew to its present total of sixteen technical colleges and centers (see Figure 1). Under the supervision of local area commissions and the guidance of the State Board, these institutions provide a comprehensive state-wide educational system (TEC). The underlying theme for the development of TEC has been its commitment to train highly qualified technicians to meet the needs of new and expanding industry.

Over the years, TEC has become a strong leader in technical education offering the advantage of a built-in consortium with an aggressive State Board providing leadership to the sixteen institutions as they in turn provide valuable technical training for the people of South Carolina.

Typical of the developmental leadership the State Board provides for the system is the state-wide curriculum development project in Civil Engineering Technology. In 1973, the State Board, through its Division of Educational Services, received a National Science Foundation grant to develop an individually-paced instructional format for the state-wide Civil Engineering Technology curriculum in South Carolina. The grant was funded for thirty-nine months and is administered through the Foundation's Science and Engineering Technician Education Program.

The project was designed to accomplish three basic objectives:

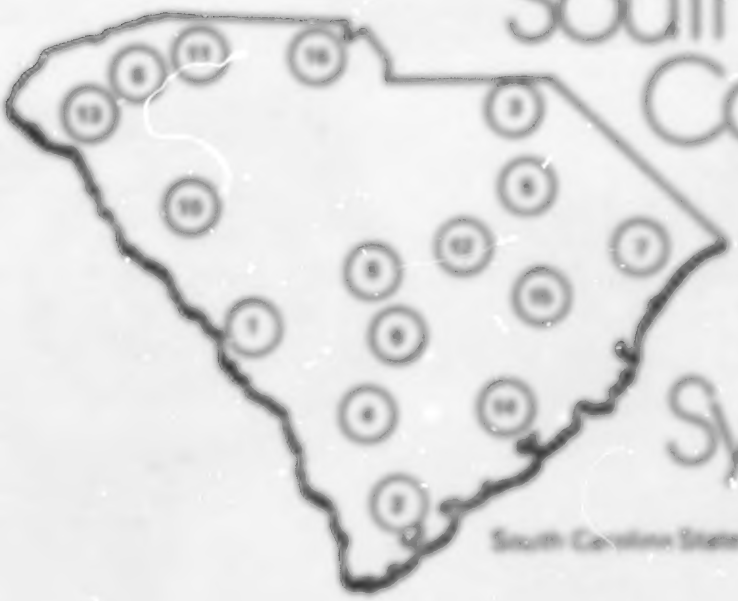
1. to identify the specific competencies required of a civil engineering technician,
2. to develop an individualized, self pacing instructional format complete with software and equipment, and
3. to test and validate all items being developed.

The ultimate goal of the project is to develop a learner-oriented, open-entry/open-ended instructional format which relies heavily on the uses of audiovisuals and hands-on experience.

SIGNIFICANCE AND SCOPE OF THE ORIGINAL PROPOSAL

The original project, as funded by NSF, addresses itself to several educational problems of national concern, specifically student recruitment, attrition, and the problem of dealing with varying student ability levels within a given course curriculum. The concept of the individually-paced curriculum in this project is directly aimed at the alleviation of such problem areas.

It is hypothesized that the need to seek out and recruit interested students will be aided by an individually-paced curriculum which would enable a student to enter the program at any point during the year even though the introductory courses might not normally be scheduled at the time he wishes to enter. Furthermore, the inherent flexibility of the individually-paced curriculum is particularly valuable in enticing working students and others who may need to make special time arrangements not possible under traditional education programs.



South Carolina's Technical Education System

South Carolina State Board for Technical and Comprehensive Education

TECHNICAL EDUCATION

1 [illegible]

2 [illegible]

3 [illegible]

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5 [illegible]

6 [illegible]

7 [illegible]

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10 [illegible]

11 [illegible]

12 [illegible]

13 [illegible]

14 [illegible]

15 [illegible]

16 [illegible]

Figure 1. Location of South Carolina's sixteen technical education colleges and centers.

Another hypothesis of this project is that the diversity and resultant motivation provided by a creatively engineered, individually-paced curriculum will attack the problem of at-risk students more effectively than the traditional teacher-oriented approach. A student's ability to individually-pace portion of learning materials to match levels of the objectives and the difficulty of each unit being studied and to thereby involved in the total learning process rather than a final passive being the recipient of it. The "hands-on" experiences aimed for in this project are translations theory into reality for the work-oriented student. The diversity of the learning techniques associated within the self-paced curriculum is directed at the creation and retention of student interaction in the various subject areas being covered. Should a student fail to meet necessary marks to graduate, the individually-paced concept gives him a viable alternative to dropping out of the program by enabling him to repeat courses or segments of courses without suffering the loss of another whole quarter, encompasses the repetition of a course.

It is further hypothesized that the individually paced curriculum will substantially affect the students' level of success by recognizing and allowing for their individual abilities and learning rates. Under this concept, a student can be met at his present level of proficiency, an unit progress from that point at his own rate.

Furthermore, not all students learn best by listening and reading. The [illegible] implemented under this student oriented strategy is designed to provide a multi-[illegible] approach to learning in an attempt to successfully reach students with varying degrees of verbal [illegible].

An adequately developed individually paced program should allow students to [illegible] choose, initiate, and follow through a specific learning technique on a given subject[illegible]. Also[illegible], the instructor to serve, not as the traditional dissemination of knowledge, but [illegible] as a resource expert in the field who is duly to give individual attention when needed.

ORGANIZATION AND ADMINISTRATION

The project was started with a Director in March of 1972 [illegible] the by faculty in Civil Technology within the Civil Engineering Technology (CET) program were employed to form a nucleus of course content experts.

An Associate Director was employed in June of the same year to coordinate the [illegible] of audiovisual materials. Preliminary meetings of the organized faculty unit resulted in agreement on the courses that would constitute the core curriculum in Civil Engineering Technology.

The courses included in the core curriculum and adopted as target areas for the [illegible] are:

1. Statics
2. Strength of Materials
3. Structural Concrete
4. Structural Steel
5. Surveying I
6. Surveying II
7. Cost Estimating
8. Highway Design and Construction
9. Hydraulics
10. Water and Sewerage Systems
11. Soil Mechanics

[illegible]

[illegible] a consensus had been developed by the faculty members concerning the specific courses to be developed, the project staff can obtain administrative [illegible] of staff persons. To accomplish this objective, a [illegible] of meetings was held with the faculty committee. In preparation for these meetings, each person was asked, through [illegible] and cognizance, [illegible] to prepare their working course objectives. These objectives were subsequently [illegible] and available to [illegible] faculty members so that each individual was aware of other programs within the [illegible]. During subsequent faculty meetings, each [illegible] participated in the process of determining those objectives which would be considered [illegible] of the subject. The total result of this series of meetings was a comprehensive [illegible] of the core curriculum which resulted in a definitive list of [illegible] for the eleven courses in the [illegible] program.

The next task was to verify that the [illegible] competencies [illegible] by the consensus faculty were consistent with the needs of potential employers throughout the area. A [illegible] series of meetings was organized between representatives of faculty and industry. Although these proceedings [illegible] these meetings provided a valid and realistic list of competencies required of a [illegible] technician.

[illegible]

By [illegible] the performance [illegible] had been completed and it became the primary [illegible] to construct material for each course identified in the [illegible]. These items of [illegible] would comprise the project's [illegible] and perform the [illegible] [illegible] [illegible]. It was decided that the instructional units would be self-contained [illegible] [illegible] as a working [illegible]. It was also decided that the instructional units should be based on the concept of mastery learning with heavy emphasis on [illegible] assistance. After a careful evaluation of the [illegible] and the available [illegible] [illegible] [illegible] the [illegible] [illegible] [illegible] developed by Drs. Bloom and Mrs. Johnson [illegible] [illegible]. Basically, [illegible] system is designed to [illegible] [illegible] [illegible] through the process of [illegible] and [illegible] a unit [illegible] [illegible] [illegible]. To [illegible] [illegible] mastery learning [illegible] [illegible] [illegible]

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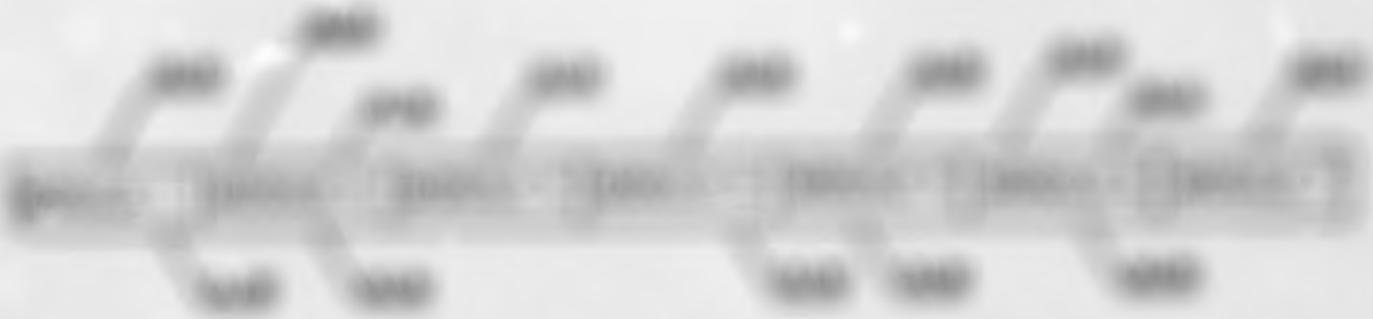

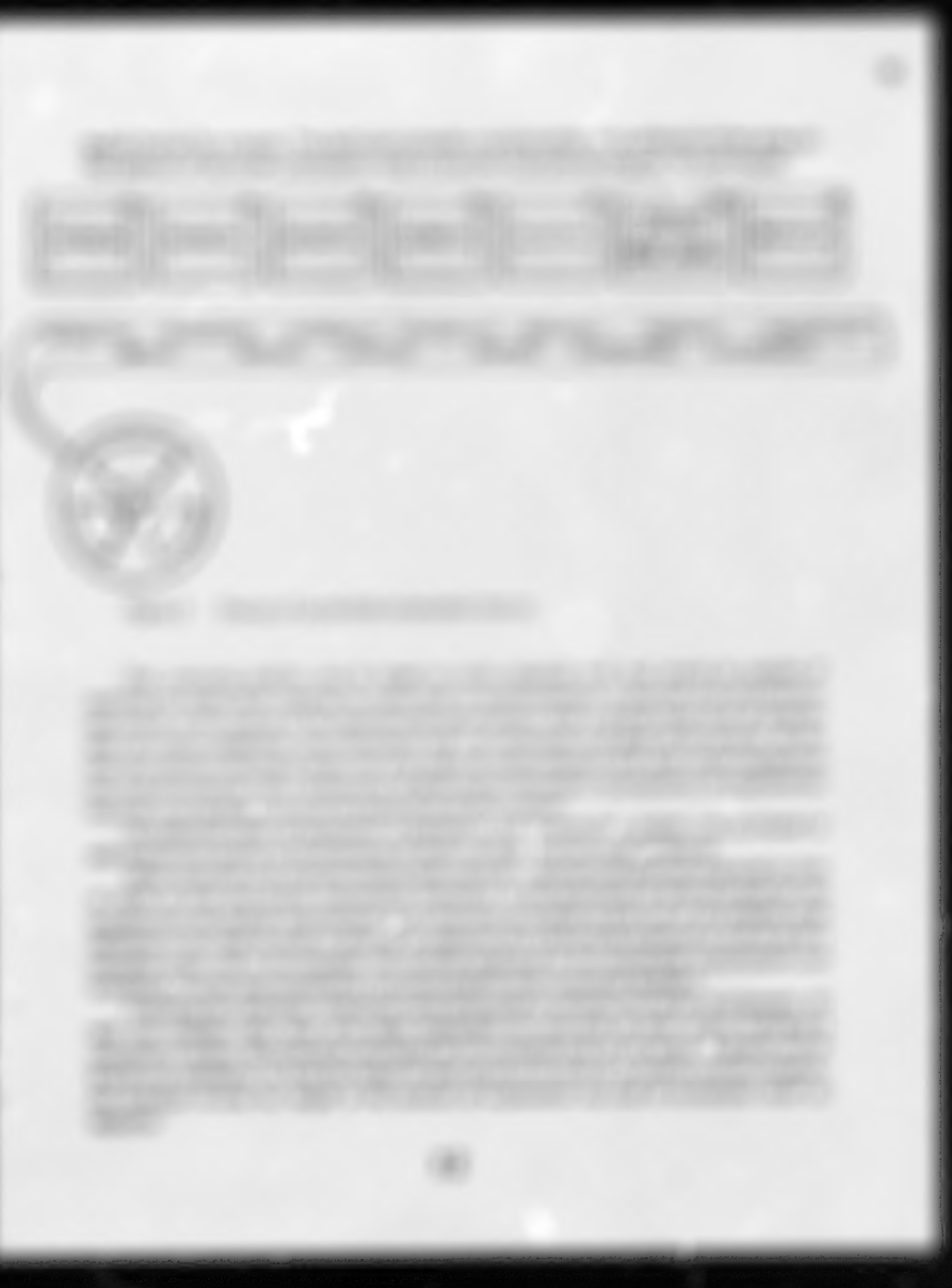

As of mid-August, more than one hundred sound slide presentations were in various stages of development. The overall goal of the project staff is to complete at least two hundred slide presentations before the termination of the project.

PROJECT EVALUATION

Simultaneously with sound slide presentation and module development, the project staff is actively engaged in a complete evaluation of all the instructional material. To fulfill this objective, a Research Associate with a strong background in testing and measurement was hired in June 1975.

A third workshop for the consortium faculty members was held shortly after the Research Associate arrived in order to introduce the participating instructors to the evaluation plan and to develop the strategy for implementing the evaluation. A tentative listing of evaluation objectives include the following:

1. Do students learn more (or better) under the individually-paced curriculum than under conventional teaching methods?

2. An individually-paced curriculum may produce a very different grade distribution than that seen in a conventional course, as many more students may receive A's and B's in an individually-paced curriculum. Are these higher grades justified?

3. Does the "average" student in an individually-paced curriculum exhibit a significantly different long-term retention of facts and concepts than the "average" student in a lecture course?

4. Can the individually-paced curriculum materials developed by a given instructor be used in another institution with roughly equivalent results? That is, are well-written individually paced curriculum courses relatively independent of who is the actual teacher, provided the teacher using them understands how the individually-paced curriculum works?

5. The majority of people who have taught self-paced courses have experienced the "procrastination problem" evidenced by a significant number of students who progress through the course at a rate much slower than average. What are the various causes of procrastination, and how may a course be designed to minimize the problem?

6. Connected with the fifth objective is the problem of dropouts. Self-paced courses regularly produce a higher dropout rate than other courses. Can this dropout percentage be reduced, and how?

7. What is the effect of class size? Does the quality of an individually-paced curriculum suffer as class size increases?

8. Do students under an individually-paced curriculum display a more positive affect toward subject matter than students under more conventional teaching methods?

The instructional material for each course will be tested by closely monitoring experimental and control groups. All eleven courses will be evaluated at various sites within the ten participating institutions during the three quarters of the 1975-1976 academic year.

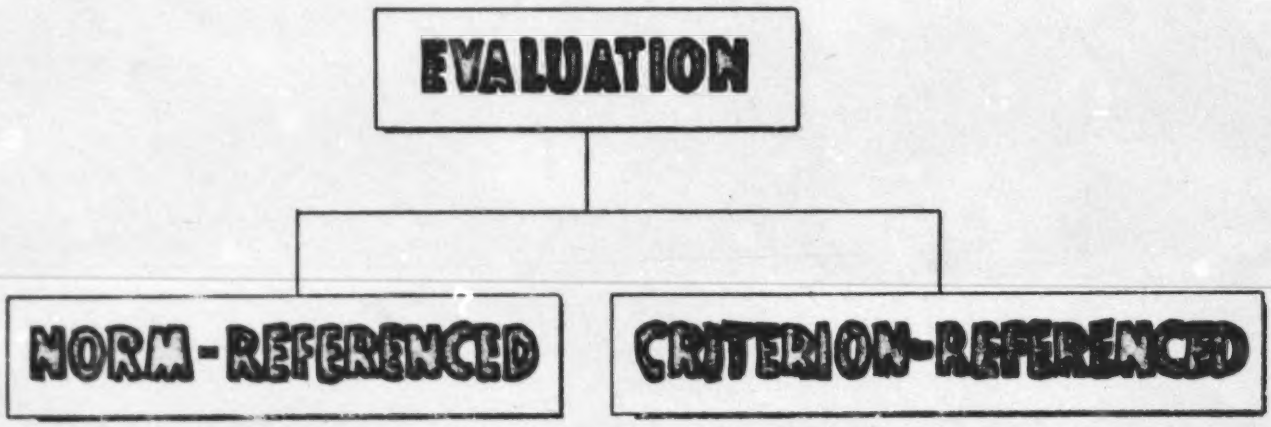

Figure 5. Evaluation emphasis.

As depicted in Figure 5, the evaluation will consist of a two-pronged approach: (1) a norm-referenced evaluation which compares the individually-paced curriculum with a lecture-based curriculum; and, (2) a criterion-referenced evaluation which determines the effectiveness of the individually-paced curriculum in respect to the pre-stated objectives.

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